

end of the sternum differing in quality and sometimes, although not necessarily, in timing, from a similar murmur at the apical region due to associated mitral stenosis. Confirmatory evidence of such auscultatory findings may be secured with the aid of simultaneous electrocardiograms and electrophonocardiograms.

Finally, fluoroscopic studies may show enlargement of the heart to the right, with dilatation or hypertrophy of the right auricle and pulsations in the superior vena cava. Such findings would certainly be considered corroborative.

384 Post Street.

RICHARD D. FRIEDLANDER,  
San Francisco.

#### DIPHYLLOBOTHRIUM LARVAE IN TROUT OF CALIFORNIA WATERS\*

Occurrence of different Diphylobotriidae has been recorded from various Eastern States of the Union. This communication deals with observations of Plerocercoids of this group in the boundaries of California. The first case concerns a privately owned lake in the Tahoe region, the second a lake in Lassen National Park. In both cases Eastern brook trout have been found afflicted. It is quite likely infections of trout by similar Plerocercoids may occur in other waters of California.

The infections were severe and often fatal to fish. Fingerlings, as well as trouts, weighing over a pound, have been killed off. The afflicted fish were less shy, swimming on or near the surface of the water before they died. There was generally no emaciation. Opened and placed in a dish of clear water, a varying and often great number of Plerocercoids could be seen emerging from the body cavity. Once liberated, the Diphylobothrium larvae were swimming for some time with the alertness of leeches. The semitransparent body was elongated, ribbon-like, and slightly rounded on both ends. Placed in alcohol they assumed a saturated white color and a conical shape. Their size has been reduced by this procedure to about a third of the body length observed during life. Most of the larvae, however, remained embedded under or in between serous membranes of the intestines. Part of the Plerocercoids has been seen resting coiled in hairpin forms, others creeping extended and surrounded by large extravasates of blood. Some larvae appeared very minute, apparently having just passed the stage of the Proceroid. Highest numbers of parasites occurred regularly in the wall of the stomach, while decreasing numbers were found in the lower intestines, liver, kidney, and peritoneum. No larvae have been encountered under the skin or in deeper parts of the muscles of the body. This localization, as well as the more delicate shape of the body, makes a differentiation of these Plerocercoids from those of Diphylobothrium latum possible. It is generally admitted that even adult stages of this group are sometimes difficult to classify. This is, of course, to a higher degree

true in regard to larval stages. No proliferation of the Plerocercoids has been seen.

Fuhrmann<sup>1</sup> seems to believe that Diphylobothrium larvae multiply by agamic proliferation, a fact which the writer has not been able to confirm in observations on his unusual large material of Diphylobothrium latum collected in the Balticum. The writer, on the contrary, could demonstrate<sup>2</sup> that the increasing numbers of Plerocercoids found in larger predatory fish result from preying on smaller fish and on spawn, the latter being often infested with Plerocercoids. In other words, the more severe infections regularly observed in larger fish result from development of Proceroids after intake of primary hosts (Copepods) and, secondly, from ingestion of Plerocercoids (by preying on smaller fish and on spawn). Trout is a predatory fish, and it is quite likely the infections described above may have resulted from similar sources. This would especially explain the high incidence of Plerocercoids encountered in the wall of the stomach of these fishes. A big trout needs something more substantial as food, as there is a small copepod or a fly larva, especially if even this food is scarce by artificially filling up lakes with trout without due regard to food supply.

The species of Diphylobothrium involved could not be established, because sickness necessitated a return to San Francisco. The studies will be continued during this year. The observations are certainly a problem for the State Fish and Game Commission, which is eager to provide a large and healthy trout population of lakes and streams. It may also be of some concern to health authorities because several species of Diphylobothrium found in the United States of America thrive in animals as well as in man.

I do not know if it is not out of place to recommend to sportsmen working in medical fields not to throw intestines of fish in water or on shore, thus providing opportunities for spread of parasitic diseases, but to burn them. If anglers could be induced by these lines to make the test mentioned above for presence of Plerocercoids (to place the opened fish in a pan of water), this would not only enlarge our knowledge of regional distribution of these Diphylobotriidae in California, but it would possibly be to their personal benefit.

The Medical Center.

M. HOBMAIER,  
San Francisco.

<sup>1</sup> Birkeland, I. W.: Bothriocephalus Anemia, Medicine, 11:1-13, 1932.

<sup>2</sup> Hobmaier, M.: Wie kommt die Infektion der Raubfische mit dem Plerocercoid von Dibothriocephalus latum zustande? Centralbl. f. Bakteriologie, 2 Abt., Orig., 72:268-273, 1927.

\* From the George Williams Hooper Foundation, University of California, San Francisco.

The required methods of work are no secret; for they have been employed by thinking individuals ever since the time of Socrates. Here one cannot build without laying foundations. One cannot, for example, be a radio expert without the principles of electricity. One cannot be a business expert without economics. One cannot be an engineer without getting a knowledge of mathematics. Thus it runs throughout the cycle of subjects. Successful work is a kind of development; so before going far one must master its preliminary and prerequisite stages. There is no other valid way. One cannot build a tower without first laying a solid foundation.